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The study on tsetse fly (*Glossina species*) and their role in the trypanosome infection rate in Birbir valley, Baro Akobo River system, western Ethiopia

Mulugeta Desta*, Sissay Menkir and Ameha Kebede

Department of Biology, College of Natural and Computational Science, Haramaya University Haramaya, Ethiopia. P.O.Box 138, Dire Dawa, Ethiopia,

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The study was conducted in Birbir valley of Oromia Regional State, Western Ethiopia from November, 2009 to July, 2010 to determine the trypanosome infection rate of *Glossina* species and to relate with season tsetse population density and epidemiology of bovine trypanosomosis. A total of 384 flies of four species were dissected. The overall infection rate of *Glossina* species was 5.98% among which 4 (1.04%) was male and 19 (4.94%) were female flies. The prevalence was significantly higher ($\chi^2 = 26.04$; *P* = 0.00) in female flies than male flies. Higher infection rates (5.46%) were observed in the morsitans group (*Glossina pallidipes and Glossina morsitans*) than the palpalis group (0.52%), (*Glossina fuscipes and Glossina tachinoides*). In determination of tsetse flies population density, flies were trapped using baited stationary traps and apparent density; species of tsetse flies and other biting flies were estimated in relation to season, altitude levels, vegetation types and traps in selected sites of the study area. Higher proportion of tsetse flies was caught in the riverine vegetation type followed by savanna, forest, bush, and cultivated areas. Designing and implementation of tsetse control should be targeted on the major cyclical vectors of the savannah tsetse flies (*G. morsitans* and *G. pallidipes*) rather than controlling the whole species, hence the cost of tsetse control and the time of operation will be reduced.

Key words: Cattle, epidemiology, *Glossina* species, infection rate, trypanosomosis, Western Ethiopia.

INTRODUCTION

Tsetse flies are biological vectors of African trypanosomosis in animals and man. Their distribution and prevalence are most influenced by spatial factors such as climate, vegetation and land utilization (Rogers et al., 1996). The occurrence and impact of trypanosomosis, on the other hand, depends on tsetse challenge, host distribution, livestock breeds, farming practices and control practices. Tsetse challenge is determined by the product of relative tsetse density, trypanosome prevalence in tsetse and the proportion of meals obtained by the tsetse from a defined host (Leak, 1988).

*Corresponding author. E-mail: mulugetadesta7@gmail.com. Tel: 0917805884 / 0924900036

Tsetse-transmitted trypanosomosis (Nagana) is one of the most ubiquitous and important constraints to agricultural development in the sub-humid and humid zones of Africa. In Ethiopia, while tsetse-borne trypanosomosis is excluding some 180,000 to 200,000 km^2 of agriculturally suitable land in the west and southwest of the country, 14 million heads of cattle, an equivalent number of small ruminants, nearly 7 million equines and 1.8 million camels, are at the risk of contracting trypanosomosis at any one time (MoARD, 2004). Tsetse-transmitted trypanosomosis in livestock are recognized as one of the main constraints in both animal and agriculture in Birbir valley, Baro Akobo River system, Western Ethiopia, preventing full use of the land to feed the rapidly increasing human population. All the owners of the cattle have been treating their cattle monthly with trypanocidal drugs locally, called “werawi”. Out of the total five species found in the country, four different species of tsetse flies are found in the study area of Birbir valley. However, various efforts of control of the diseases have been directed mainly at the parasite in the host through trypanocidal drugs, which resulted in occurrence of drug resistance (Afewerk, 1998; Tewelde, 2001). Therefore, knowing the vector-parasite interaction and having a full understanding of the complex relationships between tsetse flies (*Glossina* spp.), and the trypanosomes that they transmit is crucial in future designing and implementation of control strategies.

MATERIALS AND METHODS

Study area

The study was conducted in two districts: Dalesadi and Dalewabera of Kellem Wollega Zone in Oromia Regional State in Birbir Valley, Baro Akobo River system, Western Ethiopia, from November, 2009 to July, 2010. The area is located about 590 km from Addis Ababa at 8° 41' N and 35° 50' E (Figure 1). The agro-climatic condition of the areas alternates with long summer rainfall (June to September) and winter dry season (December to March), with an annual rainfall ranging from 1,300 to 1,600 mm. The annual mean minimum and maximum temperature is 11.0 to 15.5 and 26.1 to 33.4°C. The altitude ranges from 1,300 to 1,800 m.a.s.l. The natural vegetations have been degraded due to intensive cultivation. However, much of the cultivated lands have scattered tree covers, and in some fields different vegetation types such as savanna woodland, forest, riverine and bush lands have been grown on soil bunds to provide soil protection. Both vegetation and wild life play very important roles in the transmission of trypanosomosis, the wild life serves as reservoir of the infection and the vegetation as a habitat for the tsetse fly and wild life (National Tsetse and Trypanosomosis Investigation and Control Center (NTTICC), 1996).

Study design

The design of the research was an epidemiological cross-sectional study covering two districts in the Birbir valley at four different seasons of the year. It involved determination of tsetse infection rate, and tsetse population density. The area was stratified into two based on altitude levels that are below 1,500 m.a.s.l, and ≥ 1,500 to 1,800 m.a.s.l. The vegetation types were classified into five (bush land, cultivated land, forest, riverine and savanna woodland).

Tsetse fly collection

From November, 2009 to July, 2010, a total of 148 of 74 monoconical and 74 biconical (Challier and Laveissiere, 1973) standard traps were deployed in the two districts for tsetse fly trapping. All the traps were baited uniformly with octenol (1-oct-3-nel), acetone and three week old cow urine (Brightwell et al., 1997). Acetone was dispensed from 100 ml universal bottles with “O” sized diameter hole in the lid while urine was dispensed using filter paper. All odours were placed on the ground about 30 cm upwind of the trap. The poles of traps were greased to prevent fly predators, mainly ants. Traps were allowed to stay at the site of deployment for a period of 48 h before collection. Trap deployment sites were selected to represent all vegetation type/habitat that could be related to fly multiplication, behavior, feeding, and other related aspects. Hence riverine, savanna, forest, bushes and cultivated areas were purposely included, and extents of such habitats were recorded.

Identification and population density of tsetse flies

After 48 h of deployment, the catchments of each trap was sorted by fly species and then counted, identified and analyzed; the species of tsetse fly were identified based on the habitat and their morphology (Langridge, 1976; Ford et al., 1976; Leak and Mulatu, 1993) and for other biting flies according to their morphological structures such as size, wing venation and proboscis at the genus level (Wale and Shearer, 1997). The apparent density, species of tsetse flies and other biting flies were determined in relation to season, altitude levels, vegetation types and traps in selected sites of the study area. Tsetse flies were sexed just by observing the posterior end of the ventral aspect of the abdomen using hand lens and finger palpation. Male flies were identified by their enlarged hypopygium in the posterior ventral end of the abdomen. The apparent density of the tsetse fly was calculated as the number of tsetse catch/trap/day (Leak, 1999).

Infection rate determination

Tsetse flies were trapped using monopyramidal/conical traps which were deployed along riverside and within the nearby vegetation. The flies were collected from the trap, and before dissecting them the number of each sex and species of tsetse flies were recorded.

Ageing of tsetse flies

Male tsetse: The age estimation was done according to the degree of wear or fraying observed on the hind margin of the wing. According to the degree of wear, flies were assigned to one or other of the six categories as described by Jackson (1946) and Challier (1965). After giving the wing fray category, the age was estimated using directions for estimating the mean age of a sample of tsetse flies, and mean wing fray was calculated as the sum of each category total divided by the sum of fly number for each category

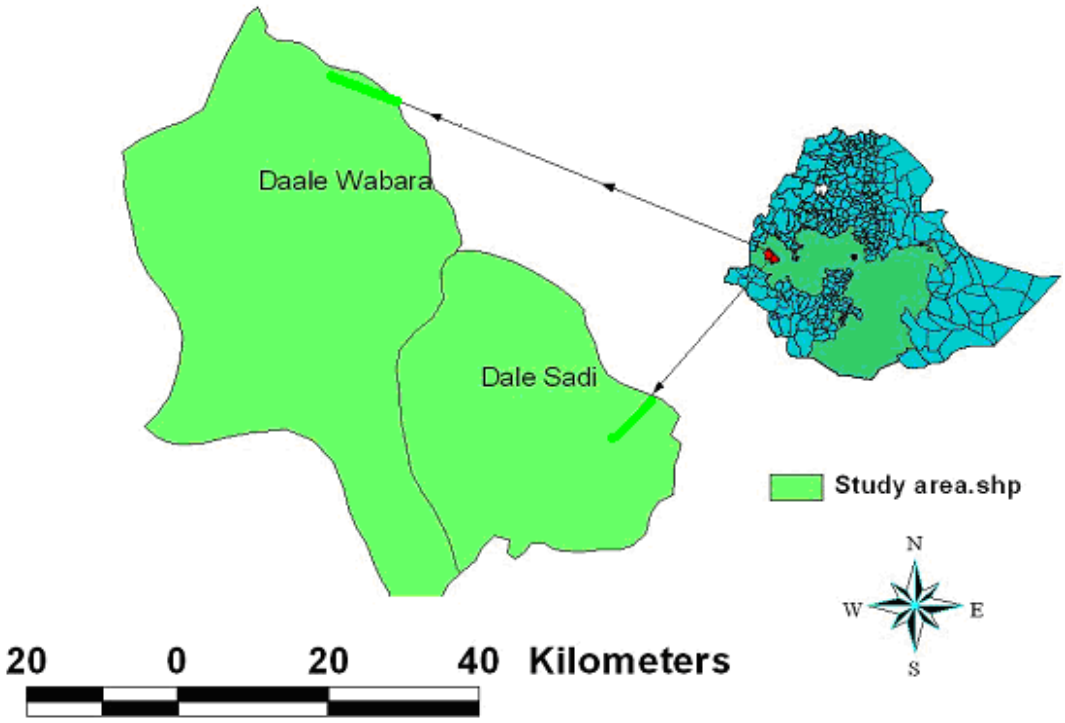

Figure 1. Location map of the study area.

and finding the given value on the table as given in the Food and Agriculture Organization (FAO) Training manual for tsetse control personnel (FAO, 2000).

Female tsetse: This method was used for the ageing of the female tsetse flies, and the flies were age graded according to the contents of the uterus and the relative development of the four ovarioles. Ageing of the female tsetse flies using ovarian age determination was done by carrying out tsetse dissection and observing the contents of the uterus and the relative size of the follicles in each of the two ovarioles and in each of the two ovules that constitute each ovary. The sub-division of each of the age category was done as described by Saunders (1962) and followed as illustrated in the FAO Training manual for tsetse control personnel (FAO, 1979).

Dissection of tsetse flies

Wings were removed from the flies and the degree of wing fray was scored on a scale of 1 to 6 (Jackson, 1946). Then, freshly killed tsetse flies were dissected under a dissecting microscope using 0.9% normal saline. A cover slip was then put on each part of the slide where the proboscis or salivary glands or the midgut (including the proventriculus) were placed, and trypanosome infections in the tsetse flies were identified using a compound microscope at a magnification of ×400 using the methods of Lloyd and Johnson (1924). Parasites found in the midgut, salivary glands and mouth parts were regarded as *Trypanozoon;* "*Trypanosoma brucei*-type", those located in the mouth parts and midguts were *Nanomonas;* "*Trypanosoma congolense*-type*"*, while those found in the mouth parts only were put in the group of *Duttonella*; *"Trypanosoma vivax*-type infection", immature infections, when only the midgut was found infected. The Infection rate (IR) was calculated using the following formula:

$$\text{Infection rate (IR)} = \frac{\text{Number of tsetse flies infected}}{\text{Total Number of tsetse flies dissected over a given period}} \times 100$$

Data analysis

Data collected based on the study methodology were inserted in to Microsoft (MS) Excel Sheets Program (Microsoft Corp.) to create a database and transferred to the statistical package for social sciences (SPSS) software programs of the computer before analysis. Descriptive statistics, confidence interval, Student's t-test, Pearson's correlation, chi-square test, multinomial logistic regression, and analysis of variance (ANOVA) were used to express results and variables like the apparent fly catches in relation to season, altitude levels, vegetation and trap types. The SPSS version 16.0 software of the computer program were applied

for the statistical analysis. For the data on fly survey, since the number of flies caught varied widely, the data was transformed to a logarithmic scale using the transformation $y = \ln (x + 1)$ before the statistical analysis. Then, Student's t-test was used to compare the difference of mean fly catch between the monoconical and biconical traps and between seasons.

RESULTS

Population density of tsetse flies

From 148 traps deployed using 50 traps in late rainy, 38 traps in dry, 30 traps in early rainy and 30 traps in wet seasons of the study period, a total of 1,546 tsetse flies were caught. Of which, 582, 263, 322, 379 flies were caught during the late rainy, dry, early rainy and wet seasons, respectively. The fly per trap per day of *Glossina* species were found to be 5.82, 3.46, 5.36 and 6.31 in the late rainy, dry, early rainy and wet seasons, respectively. The number of fly caught in the late rainy season is higher or greater than the number caught in the wet season but the density is higher in the wet season than late rainy season because it was due to difference number of traps used (Figure 2).

The different habitats of vegetation were assessed during the fly survey period and there was a variation in percentage distribution of tsetse flies in five vegetation types (Figure 3). The highest proportion of tsetse flies was caught in the riverine vegetation type ($\chi^2 = 3.937$, $P = 0.002$) followed by savanna, ($\chi^2 = 35{,}687$; $P = 0.008$), forest ($\chi^2 = 28.00$; $P = 0.003$), bush, ($\chi^2 = 233$; $P = 0.000$) and lastly cultivated areas ($\chi^2 = 114$; $P = 0.000$).

During the study period, a total of 1,258 biting flies from 3 different genera such as *Tabanus*, *Stomoxys* and *Chrysops* with the population density of 280, 674, 304, were respectively collected (Table 1). The late rainy season showed higher abundance of biting flies (437) than the dry season which is only about (74) total biting flies captured. The higher abundance of mechanically trypanosome transmitting flies (*Stomoxys, Tabanus*, and *Chrysops*) was also observed during the wet and early rainy seasons.

Comparative studies on the relative efficiency of the two traps which are commonly used for catching *G. pallidipes, G. morsitans, G. fuscipes and G. tachnoides* were made in the Birbir valley, western Ethiopia. There was significant difference between trap types for the mean catches of tsetse flies ($\chi^2 = 4.35$, $P = 0.002$). The biconical and monoconical traps were used for trapping the fly species during the study period. The relative efficiency of the two traps was found to be different in the populations of tsetse caught (Table 2). The monoconical trap was more efficient and significantly ($P < 0.05$) higher than the biconical trap in collecting flies of all the species found in the Birbir valley river basin.

Altitude has also a significant effect on the apparent density of tsetse in all seasons (Table 3). In the late rainy season, the lowland areas (<1500 m) recorded higher apparent density of 7.52 fly/trap/day than the midland areas (≥1500 to 1800 m) with 5.02 fly/trap/day while during the dry season, the apparent density of tsetse was 4.73 fly/trap/day in lowland and 1.89 fly/trap/day in midland. In the early rainy season, the apparent density of tsetse was 7.6 fly/trap/day in low land and 3.13 fly/trap/day in midland while 7.9 fly/trap/day in lowland, and 4.73 fly/trap/day in midland during the wet season (Table 3).

Trypanosome infection rate in tsetse

A total of 384 tsetse flies were dissected during the late rainy, dry, early rainy and wet seasons of the study period (2009 to 2010). The overall trypanosome infection rate of *G. pallidipes, G. morsitans, G. fuscipes* and *G. tachinoides* in all seasons were 5.88, 10.56, 1.04 and 3.44%, respectively. These results showed that *G. morsitans* has the highest trypanosome infection rate (10.56%) followed by *G. pallidipes* (5.88%), *G. tachinoides* (3.44%), and *G. fuscipes* (1.04%). The total trypanosome infection rates of all *Glossina* species in four seasons was 5.98%. The overall trypanosome infection rates of the morsitans group (*G. pallidipes* and *G. morsitans* in all seasons with infection rates of 5.88 and 10.56%, respectively) was significantly ($P = 0.001$) higher than those of the riverine group (*G. fuscipes* and *G. tachinoides* with infection rates of 1.04 and 3.44%, respectively) during the study period. The infection rate of *G. morsitans* was higher than the other three species 10.56% ($\chi^2 = 49.59$, $P = 0.000$). The trypanosome infection rates of the morsitans group (*G. pallidipes* and *G.morsitans*) during the late rainy, dry, early rainy and wet seasons were 11.76, 3.3, 4.08, 7.5, 15.78, 12.5, 9.67, 8.16%, respectively. Higher trypanosome infection rates of both *G. pallidipes* and *G. morsitans* were observed during the late rainy season of the year (11.76 and 15.78%), respectively (Table 4).

Higher trypanosome infection rate in *Glossina* species were observed during the late rainy season (8.45%) than the other seasons (Table 5). The prevalence of *T. congolense* (4.16%) was significantly ($P = 0.000$) higher than the prevalence of *T. vivax* infection (1.82%). The proportions of infected flies with *T. congolense* and *T. vivax* during the four seasons were 8.45, 5.81, 4.85 and 5.64%, respectively (Table 5). The major parasite species infecting the highest proportions of tsetse flies was *T. congolense*, with overall infection rate of 4.16% as compared to second parasite species *T. vivax* which was

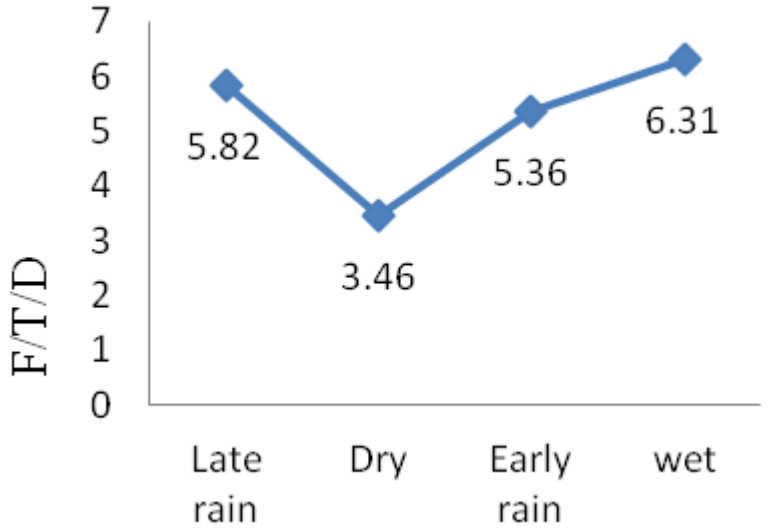

Figure 2. Apparent densities of *Glossina* species in different seasons.

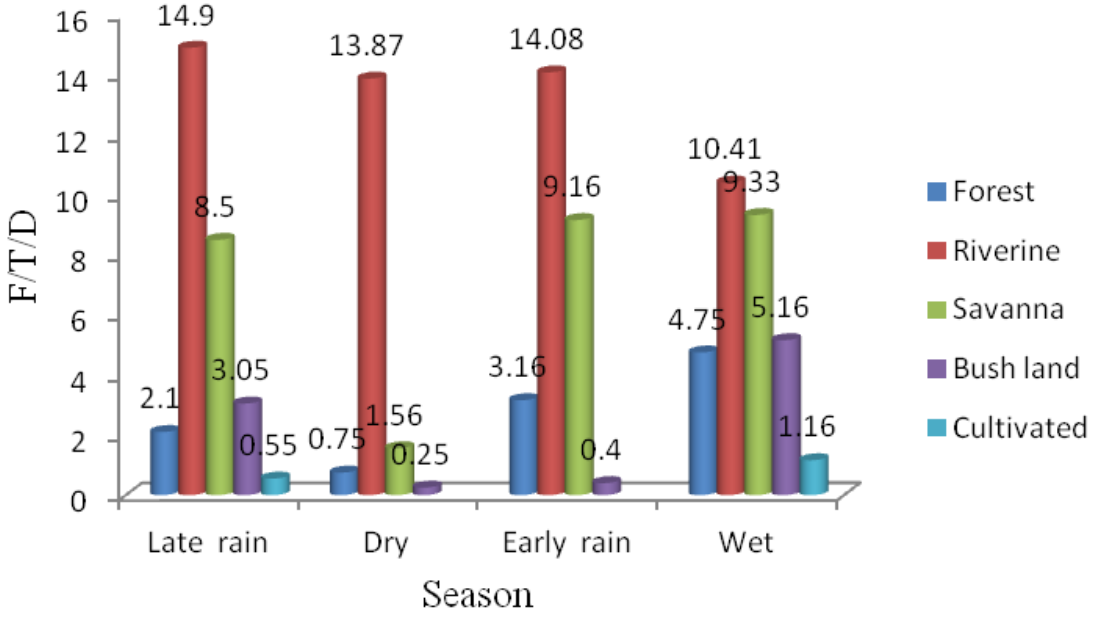

Figure 3. Percentage catches of *Glossina* species in five vegetation types.

found only in seven flies out of 384 total dissected flies (Table 5). The comparison of age and sex effect on the trypanosome infection rates of *Glossina* species are presented in the (Table 6). The average age (in days) for the trapped female flies were 26, 30, 27 and 31 while 19, 17, 20 and 22 were for trapped males during late rainy, dry, early rain and wet seasons, respectively (Table 6). The difference in infection rates between male and female were closely associated with difference in mean age of the flies (Table 6).

The total infection rates of trypanosome in female flies (4.94%) was significantly (P = 0.001) higher than the male flies 1.04% (Table 6). The number of infected female tsetse flies with trypanosome out of the total

Table 1. Other biting flies captured during the study period.

Season	Other flies			Total
	Tabanus	*Stomoxys*	*Chrysops*	
Late rainy	93	213	131	437
Dry	9	65	0	74
Early rainy	63	205	102	370
Wet	115	191	71	377
Total	280	674	304	1258

Table 2. The average fly catches in two trap types from November 2009 to July, 2010 in Birbir valley, Baro Akobo River system, Western Ethiopia.

Season	Trap type	Mean fly catches/trap/day			
		G. pallidipes	*G. fuscipes*	*G. morsitans*	*G. tachnoides*
Late rainy	Biconical	1.2	0.48	0.38	0.06
	Monoconical	2.66	3.02	2.82	1.02
Dry	Biconical	0.63	0.18	0.07	0
	Monoconical	2.13	1.92	1.44	0.6
Early rainy	Biconical	1.23	0.33	0.23	0.1
	Monoconical	2.5	2.3	3.1	0.93
Wet	Biconical	1.13	0.56	1.26	0.1
	Monoconical	3.3	2.5	3.36	0.43

(χ^2 = 4.35, *P* = 0.002).

Table 3. Apparent densities of different tsetse species in different altitude levels of the study area in Birbir river basin.

Altitude (m)	Season	*Glossina* species				Total	F/T/D
		G.p	*G.f*	*G.m*	*G.t*		
<1500	Late rainy	139	103	99	35	376	7.52
≥1500	Late rainy	54	72	61	19	206	4.12
<1500	Dry	85	51	38	17	191	5.02
≥1500	Dry	20	29	17	6	72	1.89
<1500	Early rainy	81	49	67	31	228	7.6
≥1500	Early rainy	31	30	33	0	94	3.13
<1500	Wet	82	61	78	16	237	7.9
≥1500	Wet	51	30	61	0	142	4.73

G.p= Glossina pallidipes, G.f= Glossina fuscipes, G.m= Glossina morsitans, G.t= Glossina tachinoides, F/T/D = fly per trap per day

dissected flies in each and all seasons was greater than that of the infected male tsetse flies (Table 6). The results of average trypanosome infection rates of *Glossina* species (*G. pallidipes, G. fuscipes, G. morsitans* and *G. tachnoides*) by sex of the flies were summarized and presented in Table 7. In four seasons and both sexes,

Table 4. Trypanosome infection rate of *Glossina* species by season in Birbir valley.

Season	*Glossina* species								Total dissected
	G. pallidipes		*G, morsitans*		*G. fuscipes*		*G. tachinoides*		
	N	Infected (%)	N	Infected (%)	N	Infected (%)	N	Infected (%)	Percentage (%)
Late rainy	17	2 (11.76)	19	3 (15.78)	24	1 (4.16)	11	0	71(8.45)
Dry	30	1 (3.3)	24	3 (12.5)	19	0	13	1 (7.69)	86 (5.81)
Early rainy	49	2 (4.08)	31	3 (9.67)	23	0	0	0	103 (4.85)
Wet	40	3 (7.5)	49	4 (8.16)	30	0	5	0	124 (5.64)
Total	136	8 (5.88)	123	13 (10.56)	96	1 (1.04)	29	1 (3.44)	384 (5.98)

Season; χ^2= 16.22; *P*= 0.001

Table 5. The number of tsetse flies dissected by season and the percentages found infected with the various types of trypanosomes over the study period (2009 to 2010).

Season	Infections found						χ^2 - value	P-value
	T. congolense		*T. vivax*		Total			
	N	Infected (%)	N	Infected (%)	N	Infected (%)		
Late rainy [a]	71	4 (5.63)	71	2 (2.81)	71	6 (8.45)	16.22	0.001
Dry	86	4 (4.65)	86	1 (1.16)	86	5 (5.81)	-	-
Early rainy	103	2 (1.94)	103	3 (2.91)	103	5 (4.85)	-	-
Wet	124	6 (4.83)	124	1 (0.8)	124	7 (5.64)	-	-
Total[b]	384	16 (4.16)	384	7 (1.82)	384	23 (5.98)	3.22	0. 000

[a]χ^2-Test assessing the significance of the variation of trypanosome infection prevalence in tsetse by season. [b]Refers to the variation in percentages of the total number of tsetse found infected with *congolense*-type and *vivax*-type trypanosomes.

Table 6. The number age and sex of dissected tsetse flies and the trypanosome infection rate (%).

Season	Fly dissected	Sex		Age in days		Infection rate		*P*-value
		M	F	M	F	M	F	
						N (%)	N (%)	
Late rainy	71	28	43	19	26	2 (2.8)	4 (5.6)	
Dry	86	34	52	17	30	0	5 (5.8)	
Early rainy	103	38	65	20	27	1 (0.97)	4 (3.88)	*P*=0.001
Wet	124	42	82	22	31	1 (0.8)	6 (4.8)	
Total	384	142	242	19.5	28.5	4 (1.04)	19 (4.94)	

total of 136, 96,123 and 29 flies of *G. pallidipes, G. fuscipes, G. morsitans* and *G. tachnoides,* respectively were dissected and examined for the presence of any trypanosome parasite species. Regardless of the sex of tsetse flies, the overall trypanosome infection rate of *G. pallidipes, G. fuscipes, G. morsitans,* and *G. tachnoides* were 5.88, 1.04, 10.6 and 3.44%, respectively. Significant differences was observed in trypanosome infection rate between male and female dissected which were 1.04 and 4.94%, respectively higher in females (χ^2 = 26.04; *P* = 0.000) than males.

DISCUSSION

Results on fly survey in this study have revealed the

Table 7. The total number of male and female dissected *Glossina* species and the overall infection rate (IR) over the study period (2009 to 2010).

Parameter	*G.p*	*G.f*	*G.m*	*G.t*	Total	χ^2-value	P-value
Total number of tsetse dissected	136	96	123	29	384		
Total number of tsetse infected	8	1	13	1	23		
Overall infection rate (IR %)	5.88	1.04	10.6	3.44	5.98%		
Number of male flies dissected	49	34	43	16	142	26.04	0. 000
Number of male flies infected	1	1	2	0	4 (1.04%)		
Number of female flies dissected	87	62	80	13	242		
Number of female flies infected	7	0	11	1	19 (4.94%)		

G.p= *G.pallidipes*; G.f = *G.fuscipes*; G.m= *G.morsitans*; G.t= *G.tachnoides.*

presence of four *Glossina* species and other biting flies including *Stomoxys*, *Chrysops*, *Tabanus*, in the Birbir valley, Baro Akobo river system. The overall apparent density of flies was 5.22 flies/trap/day (F/T/D). Seasonal comparison of fly catches during the study seasons at Birbir and Ketto river basin indicate that there is a remarkably significant variation in fly density and species. The Student's t-test method was employed to compute the variation between *Glossina* species in different seasons. Relatively lower fly catch was observed in the dry season of the study period. The apparent density of the different flies was significantly very high during the wet seasons. Similar results were reported by Msangi (1999), Mohamed and Dairri (1987) and Leak (1988). This could suggest an absolute increase in the number of tsetse flies due to favorable environmental conditions (Brightwell et al., 1997; Leak and Mulatu, 1993).

Sex ratio and age composition of the flies were assessed, with exception of *G. tachnoides*, higher numbers of female and adult flies were recorded during the present study. Similar results have been reported by Msangi (1999) and Mohamed and Dairri (1987). Leak (1999) showed that in unbiased sample, female would comprise between 70 to 80% of the mean population. The different habitats of vegetation were assessed during the fly survey period and there was a variation in percentage distribution of tsetse flies in five vegetation types. Relatively higher flies were caught during the wet season in all vegetation types while most tsetse populations were captured in the riverine than in other vegetation types during dry period. This was also indicated by Rogers and Randolph (1985).

Most tsetse populations show regular fluctuations which are correlated with seasonal changes in temperature and relative humidity during the hot season. The biconical and monoconical traps were used for trapping the fly species during the study period. The relative efficiency of the two traps was found to be different in the populations of tsetse caught (Table 2). The monoconical trap was more efficient and significantly ($P < 0.05$) higher than the biconical trap in collecting flies of all the species found in the Birbir valley river basin.

Similar report of this finding is indicated by Leak et al. (1988) that biconical trap was not efficient in collection of *G. morsitans*. Here, the reason was that biconical trap was not moveable when compared to monoconical trap. The geographical distribution of the whole species found in Birbir valley was along river valley of a gallery forest protected for coffee production and savanna woodland in the lower Birbir and Ketto river basin. Earlier works by Krug (1971), Ford et al. (1976) and Langridge 1976) had established the tsetse geographical limit at 1,600 m.a.s.l, and later Tikubet and Gemechu (1984) have shown that the upper limit reaches to 2,000 m.a.s.l while in the present survey the maximum limit was 1,800 m.a.s.l. Most of the tsetse flies were caught in the lowland areas hence the apparent density decreases as altitude increases. This survey result supports earlier works by Langridge (1976) and Leak (1999) indicated that climate, which is largely dependent on altitude has an impact on tsetse population.

The observed variation in the trypanosome infection rate of *Glossina* species can be explained with reference to the preferences in terms of habitat and hosts which affects the epidemiology of animal trypanosomosis (Riordan 1977). The morsitans group inhabits the savanna woodland which in addition to large extensive area is more likely to be the habitat of domestic livestock and of game animals which serves as reservoir of trypanosome infection. The palpalis group is usually in habitats in the area largely confined to gallery forest where the degree of contact with livestock is limited. There is therefore likely to be present, a low trypanosome infection rate. The current finding is in agreement with the work of Riordan (1977). In the higher infection rate and wider distribution (Ford et al., 1976), the morsitans group may

play the highest role in the cyclical transmission of trypanosomosis in domestic animals and are considered as potential vectors. Regardless of the sex of tsetse flies, the overall trypanosome infection rate of *G. pallidipes, G. fuscipes, G. morsitans,* and *G. tachnoides* were 5.88, 1.04, 10.6 and 3.44%, respectively. Significant differences was observed in trypanosome infection rate between male and female dissected which were 1.04 and 4.94%, respectively higher in females (χ^2 = 26.04; *P* = 0.000) than males as a result of age differences. All the four *Glossina* species encountered in this finding are capable of transmitting the trypanosomosis; however, their infection rates would be influenced by season age and their habitat. Older flies are more likely to mature with trypanosome infection than younger, this is because an older fly will have more chance to become infected and an older fly will have more time for its infection to become mature (FAO, 2000).

Conclusion

All species of tsetse flies found in Ethiopia except *G. longipennis* were the main vectors of pathogenic trypanosome in the Birbir river basin; however the major cyclical vectors are the savannah tsetse flies, particularly *G. morsitans* and *G. pallidipes*, therefore, designing and implementation of tsetse control should be targeted on the vectors of the savannah tsetse flies (*G. morsitans* and *G. pallidipes*) rather tha controlling the whole species, hence the cost of tsetse control and the time of operation will be reduced

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